Special Article

Epistemology and Uncertainty in Primary Care: An Exploratory Study

Lance Evans, PhD; David R.M. Trotter, MA

Background and Objectives: *Primary care is an endeavor marked by breadth, complexity, and more clinical uncertainty than all non-primary care specialties except psychiatry. This is significant, as uncertainty is associated with a variety of troublesome economic and clinical indicators. Researchers have identified the three types of cognitive resources needed to combat uncertainty (technical, personal, or conceptual), as well as the affective stress reactions physicians have when confronted with uncertainty. In this study, we explored the relationship between primary care physicians' stress reactions to uncertainty and the conceptual resource of epistemology.* Methods: *Using Likert-type measures of epistemology and stress reactions to uncertainty, we conducted a cross-sectional survey with 78 board-certified and resident physicians in primary care. A simple bivariate regression analysis was performed to identify the relationship between epistemology and stress reactions to uncertainty (Model 1), and a multivariate regression analysis was performed to test for the independent effect of epistemology on stress reactions to uncertainty while controlling for gender, specialty, and professional development status (Model 2).* Results: *Physician epistemology and stress reactions to uncertainty were significantly related in both models.* Conclusions: *Among primary care physicians, a biopsychosocial epistemology is associated with less stress reactions to uncertainty, and a biomedical epistemology is associated with more stress reactions to uncertainty.*

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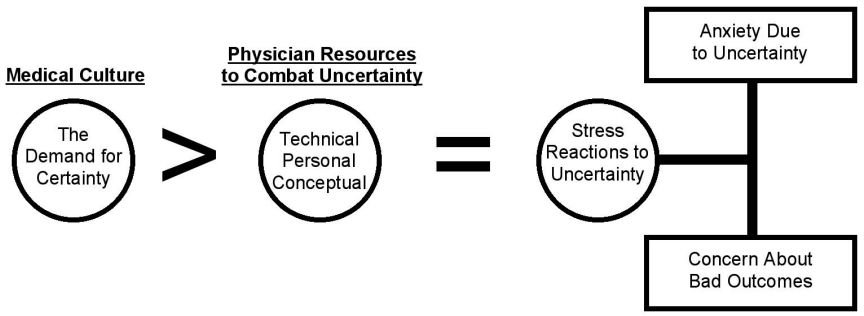
Primary care is distinguished philosophically by its broad scope, generalist orientation, focus on continuity, and recognition of psychosocial factors in the process and outcome of health problems.[1] Functionally, the practice of primary care is often characterized by undifferentiated diagnostic situations that are complicated by a patient's biological, psychological, and social presentation.[2-3] Given the breadth and complexity these descriptions suggest, it is not surprising that physicians in the three major primary care specialties (general internal medicine, family medicine, and general pediatrics) report experiences of uncertainty more frequently than all non-primary care physicians except psychiatrists.[4] While uncertainty is a common concern for physicians of all specialties,[5] the higher rate among primary care physicians is significant because uncertainty is associated with a variety of troublesome economic and clinical indicators (eg, higher clinic costs, variability in diagnosis, and practice behavior).[6-16]

Researchers report the source of uncertainty as inadequate resources in three types of knowledge: technical (inadequate technical or procedural knowledge), personal (not knowing patients' wishes), or conceptual (difficulty applying abstract criteria to concrete situations).[17-18] Although this research suggests that uncertainty is primarily a function of knowledge acquisition, processing, and recall, the experience of uncertainty is not merely a cognitive phenomenon. On the contrary, Gerrity et al[4,19-20] have identified two stress-related reactions that physicians experience when confronted with uncertainty: anxiety due to uncertainty and concern about bad outcomes. Gerrity et al's research is a unique application of Lazarus'[21] classic model of stress and is notable for its recognition of the cultural context in which clinical uncertainty takes place (a medical culture that demands certainty) and the affective stress reactions physicians experience when their technical, personal, or conceptual resources are unable to meet the demand for certainty (Figure 1). Given the influence of affect on workplace behavior and decision making,[22] physician stress reactions to uncertainty may

From the Department of Family and Community Medicine, Texas Tech University Health Sciences Center (Dr Evans and Mr Trotter); and Department of Psychology, Texas Tech University (Mr Trotter).

Figure 1

Physician Stress Reactions to Uncertainty



be a contributing factor in the troublesome economic and clinical uncertainty correlates noted earlier. As such, the relationship, if any, between primary care physicians' technical, personal, or conceptual resources and affective reactions to uncertainty merits empirical study.

Discussions and studies concerning the technical and personal resources available to physicians to combat uncertainty can be found elsewhere;[17,18,23-29] the focus of our study was on conceptual resources. Conceptual resources include models or guidelines that are used to organize clinical complexity and decrease uncertainty. However, because they are by definition abstractions, models and guidelines can fail in their intended purpose if the abstract criteria upon which they are based cannot be applied to real-life clinical situations. Conceptual resources in medicine are myriad. One conceptual resource that has received little scientific inquiry, however, is epistemology.

Epistemology

Epistemology, as a discipline, is the branch of philosophy concerned with how knowledge is acquired and validated.[30] At an individual level, an epistemology is a belief system about knowledge that determines how one organizes, interprets, and abstracts meaning from information or stimuli. In a medical context, an epistemology determines how a physician understands and organizes the complexity of a patient's biological, psychological, and social presentation,[31] and it is the conceptual basis of a physician's diagnostic and treatment decisions. Thus, a physician's epistemology is a significant conceptual resource in combating uncertainty.

Central to an epistemology are the *a priori* assumptions about knowledge that determine which types of clinical data are relevant and which types are not. In the West, the practice of medicine has been primarily influenced by two epistemologies: the biomedical model and the biopsychosocial model. A thorough explication of these models is available elsewhere;[32,33] however, the models and corresponding assumptions are briefly described in Table 1.

Table 1

Comparison of the Biomedical Model and the Biopsychosocial Model

Characteristic	*Biomedical Model*	*Biopsychosocial Model*
A priori assumptions	Dualism—no relationship between the mind and the body; mind and body are distinct and separate entities. Biological Reductionism—health problems are only explainable by analysis and reduction into smaller cellular and molecular parts.	General Systems Theory—assumes a complex, reciprocal relationship between the mind and body; a holistic perspective; health problems are at once a biological, psychological, and social experience.
Relevant clinical data	Biological data are primary; psychological and social data are ignored or viewed as peripheral or irrelevant.	Biological, psychological, and social data are given equal weight, as they function interdependently and affect the process and outcome of care.
Clinical metaphor	Biological machine	An organic network
Medical problems	Disease—the result of a pathological process; a structural or functional abnormality in the biological machine.	Illness—an experience of not being well that may or may not be the result of a pathological process.
Clinician metaphor	Specialist mechanic	General systems administrator
Clinical approach	Identification, by "artful" analysis, and treatment of the structural or functional abnormality in the biological machine.	Treatment based on an integrative assessment of patient's biological, psychological, and social functioning.

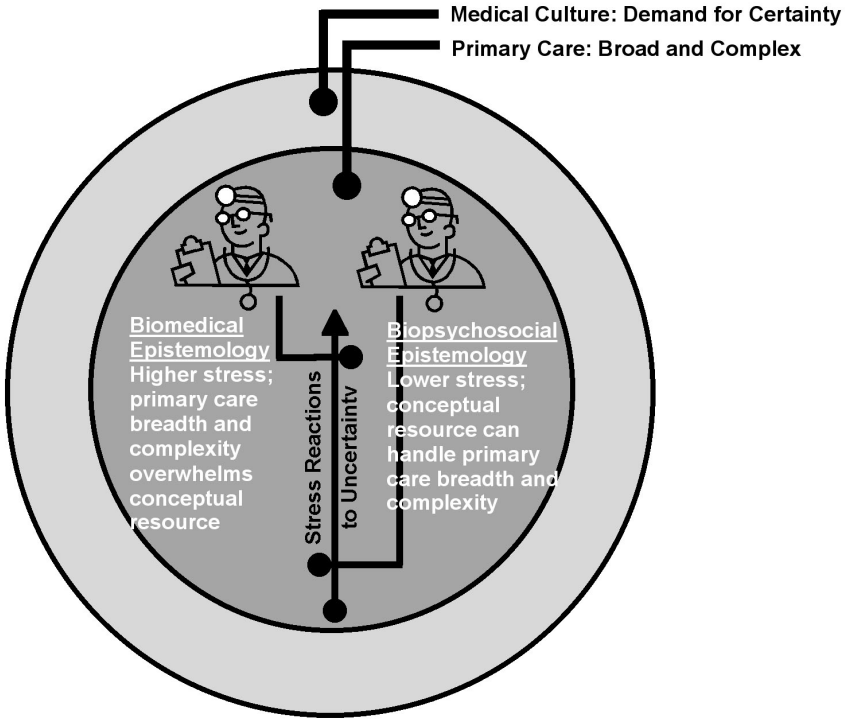
Objectives and Hypothesis

The objective of this study was to investigate the relationship between primary care physicians' stress reactions to uncertainty and the conceptual resource of epistemology. The two epistemological resources under investigation were the biopsychosocial model and the biomedical model. Given the breadth and complexity of primary care—as well as the need to attend to patients' biological, psychological, and social presentation—we hypothesized that a biomedical epistemology would be associated with more stress reactions to uncertainty, and a biopsychosocial epistemology would be associated with less stress reactions to uncertainty (Figure 2).

The rationale for this hypothesis is based on the assumptions and characteristics of each epistemology (Table 1). For example, a biopsychosocial epistemology provides a comprehensive conceptual resource for integrating patients' biological, psychological, and social presentation into a coherent clinical whole.[34] As such, we theorized that primary care physicians who adopt this epistemology would have conceptual resources less susceptible to being overwhelmed by the breadth and complexity inherent to primary care and would thus experience less stress reactions to uncertainty. Likewise, a biomedical epistemology is a dualistic and reductionist conceptual resource that makes no attempt to integrate patients' biological, psychological, and social presentation into a coherent clinical whole.[35] Therefore, we theorized that primary care physicians who adopt this epistemology would experience psychological and social data as burdensome distractions that overwhelm the conceptual resource and increase stress reactions to uncertainty. Support for our hypothesis could have important clinical and educational implications.

Figure 2

Conceptual Resources and Stress Reactions to Uncertainty in Primary Care



Methods

Participants and Procedures

Eligible participants for this study included primary care physicians (board-certified physicians or resident physicians) working in a Midwestern academic medical center. From this eligible population, 103 physicians working in general internal medicine, family medicine, or general pediatrics were invited to participate in this study. Physicians were surveyed in group settings (eg, faculty meetings, resident meetings) and were informed about the purpose of the study. Participation was elective, and all responses were number coded to protect participant anonymity. Data collection spanned May–June 2003 and included a 61-item questionnaire comprised of demographic information and measures of epistemology and stress reactions to uncertainty. All study procedures were approved by the Institutional Review Board of the participating academic medical center.

Measures

Epistemology was measured using the Physicians' Belief Scale (PBS),[36] a 32-item, self-report measure of beliefs about the psychosocial aspect of patient care. The items are presented in the form of statements (eg, "I do not focus on psychosocial problems until I have ruled out organic disease"), and respondents are asked to indicate the degree to which they agree or disagree with each statement based on a 5-point Likert scale. Scores for the PBS are derived by summing the Likert values associated with each item. Scores can range from 32 to 160, with lower scores indicating a biopsychosocial epistemology and higher scores indicating a biomedical epistemology. Psychometric data in support of the PBS have been reported, including content,

concurrent, and construct validity, as well as adequate internal consistency.[36-37]

Stress reactions to uncertainty were measured using two subscales on the Physicians' Reactions to Uncertainty Scale (PRUS): Anxiety-Due-to-Uncertainty (five items) and Concern-About-Bad-Outcomes (three items).[19-20] Combined, these two subscales measure affective, "stress" reactions to uncertainty. The items are presented in the form of statements (eg, "I find the uncertainty involved in patient care disconcerting"), and respondents are asked to indicate the degree to which they agree or disagree with each statement based on a 6-point Likert scale. Scores are derived by summing the Likert values associated with each item. Higher scores on the combined subscales indicate a greater level of stress reactions to uncertainty. Content, concurrent, and construct validity, as well as adequate internal consistency have been reported.[4,19-20]

Data Analysis

Analyses were conducted using SPSS (version 16.0.01, 2007, SPSS, Inc, Chicago). Demographic responses were analyzed by frequency, and descriptive statistics were calculated. Prior research results[4,16,19-20,36,38-40] suggest that scores on the PRUS and the PBS may be associated with gender, specialty, and professional developmental status (ie, resident versus years post-residency). To test this finding in our sample, preliminary one-way ANOVAs were conducted to check for significant differences on the PRUS and the PBS based on these three variables.

Our primary hypothesis was tested via two regression models. The first model was a simple bivariate regression with PRUS scores as the dependent variable and PBS scores as the independent variable. The second model was a multivariate regression to test for the independent effect of PBS scores on PRUS scores while controlling for gender, specialty, and professional developmental status.

Results

A total of 103 primary care physicians were invited to take part in this study; 76% (n=78) consented to participate. Demographic characteristics of the participants are presented in Table 2. The six preliminary one-way ANOVAs (Table 3) indicated significant differences on the PRUS, but not the PBS, based on gender, specialty, and professional developmental status. Consistent with our hypothesis, the first regression model indicated a significant positive relationship between PBS and PRUS scores (β=.36, *P*=.001). However, the independent effect of the PBS on PRUS scores was slightly reduced (β=.30, *P*=.007) when gender, specialty, and professional developmental status were added to the second regression model (Table 4). Results from the second model also indicated that of the three variables found to have a significant effect on PRUS scores, only the difference between family medicine physicians and pediatric physicians remained statistically significant (β=-.35, *P* =.013). There were no other significant findings.

Discussion

This research study was an exploration of the relationship between primary care physicians' epistemology and stress reactions to uncertainty. As hypothesized, our results indicate that a biomedical epistemology is associated with more stress reactions to uncertainty, and a biopsychosocial epistemology is associated with less stress reactions to uncertainty. The relationship between these two variables evidenced a medium

Table 2

Physician Demographics (n=78)

Variable	*n*	*%*
Age (years)		
26–30	31	39.7
31–40	26	33.4
41–50	11	14.1
51–63	10	12.8
Gender		
Male	42	53.8
Female	36	46.2
Race/ethnicity		
Caucasian	55	70.5
Asian	14	17.9
Hispanic	3	3.8
African American	2	2.6
Other	4	5.1
Professional development status		
Resident	38	48.7
1–3 years post residency	13	16.7
4–6 years post residency	7	9.0
7–10 years post residency	6	7.7
10+ years post residency	14	17.9
Specialty area		
Pediatrics	31	39.7
Family medicine	28	35.9
Internal medicine	19	24.4

effect size by behavioral science standards[41] and was greater than the mean correlation for behavioral science studies involving attitudes and beliefs.[42]

Explanation of Findings

Studies from educational psychology suggest that epistemological variance may be associated with gender,[43] specific domains or fields of study,[44] and intellectual development.[45-47] Similar patterns of variation are also thought to be associated with stress.[48] Because these types of findings have generally, but not always, been replicated in studies with physician populations,[4,16,19,20,36,38-40] we were concerned that our hypothesized relationship between physician epistemology and stress reactions to uncertainty would be confounded by these demographic variables. In our sample, mean comparisons for stress reactions to uncertainty indicated significant differences based on gender, specialty, and professional developmental status. Mean comparisons for epistemology, however, did not. Also, in our regression model, only one of these differences remained statistically significant (pediatricians' and family physicians' stress reactions to uncertainty were significantly different). The reason for these findings is unclear and should be the focus of further research. However, as our analysis indicated only a slight decrease in the relationship between epistemology and stress reactions to uncertainty when these demographic variables were added to the second regression model, our results suggest that the independent effect of epistemology on stress reactions to uncertainty is robust.

Table 3

Mean Score Differences on the PBS and the PRUS

	PBS				***PRUS***		
	Mean	*SD*	*P Value*		*Mean*	*SD*	*P Value*
Gender							
Male	76.86	12.19	.524		26.98	6.55	.038
Female	78.81	14.72			30.17	6.74	
Specialty area							
Pediatrics	79.42	13.80	.623		31.71	6.34	.001†
Family medicine	76.00	14.70			25.57	6.08	
Internal medicine	77.63	10.64			27.37	6.50	
Professional development status							
Resident	81.00	14.97	.123		30.13	6.31	.023‡
1–3 years post residency	74.92	10.74			27.54	5.87	
4–6 years post residency	77.14	10.49			31.14	6.12	
7–10 years post residency	80.83	14.36			28.00	10.33	
10+ years post residency	70.57	9.18			23.57	5.53	

PBS—Physicians' Belief Scale (Higher scores indicate a biomedical epistemology; lower scores indicate a biopsychosocial epistemology).

PRUS—Physicians' Reactions to Uncertainty Scale: Stress Subscales (Higher scores indicate more stress reactions to uncertainty; lower scores indicate less stress reactions to uncertainty).

SD—standard deviation

Statistically significant post-hoc comparisons (Tukey's HSD test):
† Family medicine and pediatrics
‡ 10+ years post residency and resident

The cross-sectional design and exploratory nature of this study limit our ability to offer causal explanations about the relationship between epistemology and stress reactions to uncertainty. However, as we originally theorized, it is possible that because the epistemologies are so foundationally different from one another, they lead their adherents to experience the data of primary care in fundamentally different ways. Given that these two different epistemological experiences happen in a primary care context marked by breadth, complexity, and a demand for certainty, it is not surprising that the more comprehensive and integrative epistemology (ie, the biopsychosocial model) would be associated with less stress due to uncertainty. Further research is needed to test this theory, as well as other processes, temporal factors, or uncertainty resources (technical or personal) that may influence the relationship between epistemology and stress reactions to uncertainty.

Clinical and Educational Implications

As Katz[49] has noted, physicians have a "propensity to resolve uncertainty and ambiguity by action rather than inaction." As such, it is not surprising that physician

uncertainty is associated with higher clinic costs,[6] greater expenditure of resources,[7-8] increased hospital admissions,[9] patient satisfaction,[10] excessive testing,[11] variability in diagnosis[12] and practice behavior,[13] increased morbidity and mortality,[14] and unnecessary surgery.[15] While the focus of our study was on the relationship between primary care physician epistemology and affective reactions to uncertainty, it is well documented that workplace behavior is significantly influenced by affective states.[22] As such, physician epistemology may be a factor in the behaviorally oriented reactions to uncertainty noted above. Further research is needed to investigate this potential relationship. At a minimum, however, primary care physicians should give strong consideration to how their epistemological commitment influences their affective and behavioral reactions to uncertainty.

Our findings also highlight the need to more explicitly teach medical students and residents the epistemological bases of medical practice. The reasons for this are threefold. First, it is widely accepted that the biomedical model remains the dominant epistemology in medical schools and residencies.[50-52] Second, there is evidence that learners tend to adopt the prevailing epistemology of their training environment.[53] Third, there is evidence to suggest that many physicians are unaware of epistemology or how it influences clinical practice.[54] Collectively, these factors confirm the present-day relevance of Engel's[55] nearly 3-decades-old observation about medical education: "How physicians approach patients and the problems they present is very much influenced by the conceptual models in relationship to which their knowledge and experience are organized. Commonly, however, physicians are largely unaware of the power such models exert on their thinking and behavior. This is because the dominant models are not necessarily made explicit. Rather, they become that part of the fabric of education which is taken for granted, the cultural background against which they learn to become physicians."

Presently, many medical schools and residencies teach patient-centered care[56] or humanistic medicine[57] (both of which are applied aspects of a biopsychosocial epistemology). Absent from this teaching, however, is an explicit exploration of the epistemology upon which these efforts are based, so learners tend to experience these efforts as irrelevant, confusing, or disconnected from the "realities" of medical practice.[58,59] Courses or seminars on the epistemological bases of medical practice would assist learners in critically evaluating the advantages, limitations, and *a priori* assumptions of a chosen epistemology, as well as provide an opportunity to think through the clinical implications that accompany an epistemological commitment.

Table 4

Regression Models and Coefficients for the PRUS, the PBS, and Demographic Variables

	b	*SE b*	*β*	*P Value*
Model 1				
Constant	14.18	4.29		
PBS	0.18	0.05	0.36	.001
Model 2				
Constant	19.81	4.51		
PBS	0.15	0.05	0.30	.007
Male	-0.18	1.68	-0.01	.917
Family medicine	-4.85	1.90	-0.35	.013
Internal medicine	-4.34	2.53	-0.28	.090
1–3 years post residency	-0.70	2.20	-0.04	.752
4–6 years post residency	3.67	2.92	0.16	.214
7–10 years post residency	-0.19	3.18	-0.01	.952
10+ years post residency	-1.95	2.23	-0.11	.385

n=78

PBS—Physicians' Belief Scale
PRUS—Physicians' Reactions to Uncertainty Scale

Limitations

The results of this study are subject to several limitations. First, as noted, the study used a cross-sectional design and a self-report format. While appropriate for our exploratory purposes, the self-report format is susceptible to participant distortion, and the cross-sectional design may have masked temporal relationships between situational variables and epistemology or stress reactions to uncertainty.

Another limitation involves the measurement of epistemology. Because of its abstract nature, epistemology is characterized as a belief or attitude in the literature, and researchers have generally found beliefs and attitudes challenging to measure for predictive purposes.[60]

Finally, the population used in our study was limited to a self-selected convenience sample of primary care physicians from a single academic medical center. As such, the results may not be generalizable to other physician specialties or to other primary care physicians who do not work in academic medical centers.

Conclusions

The results of our study suggest that among primary care physicians, a biopsychosocial epistemology is associated with less stress reactions to uncertainty, and a biomedical epistemology is associated with more stress reactions to uncertainty, even when controlling for gender, specialty, and professional developmental status. More research is needed to confirm our findings, as well as to investigate other factors or processes that affect the relationship between epistemology and stress reactions to uncertainty.

In addition, given the influence of affect on workplace behavior, more research is needed to investigate how the epistemology-stress reactions to uncertainty relationship affects primary care physician clinical behavior and decision making. In the interim, our results highlight the need among primary care physicians and educators alike for a deeper understanding of epistemology and its influence on stress reactions to uncertainty.

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Corresponding Author: Address correspondence to Dr Evans, Texas Tech University Health Sciences Center, Department of Family and Community Medicine, 3601 4th Street, Lubbock, TX 79430-8143. 806-743-1100, ext. 262. Fax: 806-743-3955. lance.evans@ttuhsc.edu.

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